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EXAMINER	
DINH, BACH T	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/552,618	CRAMER ET AL.	
	Examiner	Art Unit	
	BACH DINH	1724	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 January 2011*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5)☒ Claim(s) *11-13,15-23,25-29,32,35 and 37-41* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *11-13, 15-23, 25-29, 32, 35 and 37-41* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

12)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 01/27/2011 has been entered.

Summary

2. This is the response to the communication filed on 01/27/2011.

3. Claims 11-13, 15-23, 25-29, 32, 35 and 37-41 remain pending in the application.

4. The application is not in condition for allowance.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

6. Claims 11-13, 15-23, 25-29, 32, 35 and 37-41 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention for the following reasons:

a. The breadth of the claims is a gas sensor device comprises a constant current source that is configured to be set to at least two values of the pump current and for alternating operation including ON phases and OFF phases, with the duration of the ON phases and OFF phases being specified; and the device is configured to predefine the number of ON phases and OFF phases.

b. The invention is about a gas sensor and a device for operating a gas sensor.

c. With regard to the state of the prior art, Metrich (US 5,312,538) discloses a gas sensor device comprises a constant current source that is configured to be set to at least two values of the pump current and for alternating operation including ON phases and OFF phases, with the duration of the ON phases and OFF phases being specified (figures 2B-2D).

d. With regard to the amount of direction provided by the inventor, the specification does not explicitly disclose "the device is configured to predefine the number of ON phases and OFF phases" nor does the specification suggests the number of ON phases and OFF phases are predefined. Therefore, the specification does not provide any direction regarding "the device is configured to predefine the number of ON phases and OFF phases". However, the recitation of such limitation also contradicts the disclosure in the specification on page 5 lines 16-23 of "Given a predefined current level and predefined duration of the ON phases and/or OFF phases, the count of the number of ON phases or OFF phases within the predefined measuring time represents a direct measure for the pump current. An automatic control of the measuring voltage is possible by a control of

the constant current source as a function of a comparison between a predefined setpoint measuring voltage and the actual measuring voltage" (emphasis added); on page 12 line 33 to page 13 line 7 of "Pump current Ip may be ascertained by a simple counting operation of ON phases TD shown in figure 3b, provided first and second amounts I+, I-, of pump current Ip are of equal value. The counting is accomplished by a count of ON durations TD occurring between first and sixth instants T1, T6, and a count of ON durations TD occurring between sixth instant T6 and measuring time TM" (emphasis added) and figures 3a-3c, which show the positive constant current is applied during ON phases (figure 3b) until the measured voltage exceeds the setpoint voltage (figure 3a), at which time, the negative constant current is applied during ON phases (figure 3b, page 12 lines 11-27). In other words, the number of ON phases and OFF phases depends on the difference between the measured voltage and a setpoint voltage (page 12 lines 11-27) and the pump current is ascertained by the counting of the number of ON phases and OFF phases. Moreover, since the magnitude of the constant current and duration of the ON phases and OFF phases are fixed, the only variable that changes according to the changes in the measured voltage is the number of the ON and OFF phases; hence, the counting of the number of ON and OFF phases corresponds to the pump current. The recited limitation "the device is configured to predefine the number of On phases and OFF phases" renders the gas sensor inoperable for its intended purpose because if the magnitude of the constant current and the duration of the ON phases and OFF phases were fixed and the number of the ON and OFF phases was also predefined then it is unclear as to

which variable that changes according to the changes in the measured voltage that corresponds to the change in the oxygen concentration. For example, in figures 3a-3c, it takes five ON phases of the constant current I+ to cause the measured voltage to exceed the setpoint voltage, if the number of ON and OFF phases were predefined at four, then the pump current ascertained from four ON and OFF phases would not correspond to the actual change in the measured voltage and the change in the oxygen concentration. For the reasons above, it is unclear, without clear direction and explanation from the inventors, as to how the gas sensor is capable of measuring the oxygen concentration from the pump current when all the variables that correspond to the changes in oxygen concentration are predefined.

Lastly, in Remarks section filed 01/27/2011, the Applicant also expressed the same concern with regard to the disclosure of Metrich; specifically, "if a person must operate a device (as in Metrich) in order to determine a quantity (a number of ON phases and OFF phases) then it is unreasonable to consider that quantity to be predefined with respect to the device" (page 9 of the Remarks). Therefore, it appears that Applicant's arguments are applicable to the contradiction between the specification and the claimed subject matter for if a person must count the number of ON phases and OFF phases in order to determine the pump current or the oxygen concentration then it is unreasonable to predefine the number of ON and OFF phases.

e. The originally filed specification does not disclose "the device is configured to predefine the number of ON phases and OFF phases" nor does the

specification suggests the number of ON phases and OFF phases are predefined.

Therefore, the specification does not disclose any working examples.

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 11-13, 15-23, 25-29, 32, 35 and 37-41 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Independent claims 11 and 21 recite the limitations "the device is configured to predefine the number of ON phases and OFF phases". However, it is unclear as to how configuring the device to predefine the number of ON phases and OFF phases would affect the ability of the gas sensor to determine the concentration of oxygen when the oxygen concentration is measured by the pump current which is ascertained by counting the number of ON phases and OFF phases according to the originally filed specification. Therefore, specifying the number of ON phases and OFF phases would appear to render the gas sensor inoperable for its intended purpose. It is also unclear as to which structure of the device is configured to predefine the number of ON phases and OFF phases.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 11-13, 15, 20-23, 25, 29, 35 and 37 are rejected under 35 U.S.C. 102(b) as being anticipated by Metrich (US 5,312,538).

Addressing claims 11 and 20-21, Metrich discloses a gas sensor device (figure 1), comprising:

A sensor chamber 3 that receives via a diffusion barrier a gas to be analyzed (the aperture made in the solid electrolyte layer 5 that connects the outside to the sensor chamber 3 is equivalent to the diffusion barrier for it restricts the movement of gas into the sensor chamber 3);

At least one pump cell (the electrodes 9, 10 and the portion of the solid electrolyte layer 5 between them constitute the pump cell) situated between the sensor chamber and the gas to be analyzed, wherein the at least one pump cell is exposed to the gas to be analyzed and includes an outer pump electrode 9 (figure 1);

A measuring electrode 7 situated in a reference-gas space 4;

A measuring cell (the electrodes 6, 7 and the portion of the solid electrolyte layer 5 between them constitute the measuring cell) situated between the sensor chamber 3 and the reference gas space 4, wherein the outer pump electrode 9 of the pump cell exposed to the gas to be analyzed receives a pump current which depends on a measuring voltage that is applied to the measuring electrode situated in the reference gas space (3:5-12 and 4:21-29); and

A constant current source for supplying the pump current (4:1-29, the circuit depicted in figure 1 is the constant current source), wherein the constant current source is at least one of: a) configured to be set to at least two values of the pump current (figure 2b, Imax and –Imax) and b) configured for alternating operation with ON phases and OFF phases, the duration of the ON phases and OFF phases being specified (figure 2C, the ON phases are Imax or –Imax and the OFF phases are at the base line; furthermore, figure 2C shows that the ON and OFF phases have predetermined duration; therefore, they are being specified).

With regard to the limitation "the device is configured to predefine the number of ON phases and OFF phases", Metrich discloses applying a number of ON phases and OFF phases of the positive constant current until the measured voltage Vs switches over (figures 2A and 2C); likewise, the device of current application applies ON phases and OFF phases of the positive constant current until the measured voltage switches over (figures 3a-3b). It is clear that the device of Metrich is configured to function in the same manner as that of current application and the limitation "is configured to predefine the number of ON phases and OFF phases" is drawn to the intended use of the device. Hence, the device of Metrich is structurally capable of being configured to predefine the number of ON phases and OFF phases since the device of Metrich is already configured to perform the other functions of the claimed device.

Addressing claims 12 and 22, in figures 2B-2D, Imax is the positive polarity value and –Imax is the negative polarity value for the pump current.

Addressing claims 13 and 23, Metrich discloses the device is configured to determine an average of the pump current over a predefined measuring time (6:55-67, the average of the pump current over a predefined time t3; 7:8-33, the average pump current over a predefined time t4; time t3 and t4 are predetermined because the duration of the pump current is fixed as discussed above).

Addressing claims 15 and 25, in figure 2A, the measuring voltage Vs is recorded during the OFF phases shown in figure 2C.

Addressing claims 29, 32 and 35, figure 2C shows the Imax peaks with different durations; therefore, the device of Metrich is configured to vary the duration of at least one of the ON and OFF phases; specifically, the duration designated as t3 is different than the subsequent duration of the Imax current and the average pump current is determined based on the time t3 (6:55-67). Therefore, when the average pump current is determined based on the time t3 or based other duration time periods that is varied to be different than the time t3 (figure 2C), the device of Metrich is configured to determine the average pump current by varying the duration of at least one of the ON phases and OFF phases.

Addressing claim 37, please see the rejections of claims 12-13 and 15 above.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

7. Claims 16, 26 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Metrich (US 5,312,538) in view of Miyata et al. (US 5,895,564).

Addressing claims 16, 26 and 28, Metrich discloses the pump current is controlled based on the measuring voltage of the measuring cell (4:21-29).

Metrich is silent regarding the constant current source is controlled as a function of a differential signal of a comparator resulting from the difference between the measuring voltage and a setpoint voltage.

Miyata discloses an air-fuel ratio sensor; wherein, the pump current is controlled as a function of a differential signal of a comparator resulting from the difference between the measuring voltage and a setpoint voltage (8:41-52, the pump current is controlled as a function of the difference between the measured voltage and a

reference voltage or setpoint voltage determined by a differential amplifier or comparator). The reference voltage is 450 mV (8:53-67).

At the time of the invention, one with ordinary skill in the art would have found it obvious to modify the device of Metrich with the comparator for controlling the pump current in the manner recited by Miyata because doing so would allow one to detect the oxygen concentration quickly after the heater is energized (Miyata, 3:30-32). Furthermore, the comparator and the manner of controlling the pump current as disclosed by Miyata would still allow one to control the pump current of Metrich as well as allowing said current to be controlled without being affected by the internal resistance of the measuring cell (Miyata, 5:14-30).

8. Claims 18-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Metrich (US 5,312,538) in view of Miyata et al. (US 5,895,564) as applied to claims 16, 26 and 28 above, and further in view of Kato et al. (US 6,623,618).

Addressing claims 18-19, Miyata discloses the reference voltage is 450 mV (8:53-67).

Metrich is silent regarding air is present in the reference-gas space; however, it is well known in the art that atmospheric air is used as reference gas for an oxygen sensor.

However, lacking explicit disclosure from Metrich, Kato discloses a gas sensor; wherein, atmospheric air is introduced into the reference-chamber as the reference gas (7:66-8:6).

At the time of the invention, one with ordinary skill in the art would have found it obvious to modify the device of Metrich with using atmospheric air as reference gas because all the elements are known in the art and the difference is the combination of known elements into a single device by using the atmospheric air as reference gas. Furthermore, the atmospheric air, separate or in combination, would not have performed a materially different function for one would still obtain the predictable result of sensing the concentration of oxygen with the atmospheric air as reference as in the manner disclosed by Kato (Kato, 7:66-8:6).

9. Claims 17 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Metrich et al. (US 5,312,538) in view of Hamada et al. (US 4,824,549).

Addressing claims 17 and 27, Metrich is silent regarding a plurality of pump cells is provided and the outer electrode of each pump cell receives the pump current. Hamada discloses an oxygen gas sensor (figure 5); wherein, the sensor comprises a plurality of pump cells having a common outer pump electrode 22. Furthermore, the outer electrode 22 of the plurality of pump cells receive the pump current, which is controlled by the magnitude of the signal generated from the measuring cell (5:46-64).

At the time of the invention, one with ordinary skill in the art would have found it obvious to modify the device of Metrich with the plurality of pump cells with the outer electrode of each pump cell receiving the pump current in the manner disclosed by Hamada because doing so would allow one to compensate for the

sensor output for a chronological change (Hamada, 5:46-64) and improving the sensitivity of the sensor (Hamada, 5:7-11).

10. Claims 38-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Metrich (US 5,312,538) in view of Miyata et al. (US 5,895,564), Kato et al. (US 6,623,618) and Hamada et al. (US 4,824,549).

Addressing claims 38-39, with respect to the limitation "wherein the gas sensor device ... exposed to the exhaust gas", please see the rejection of claim 20 above and figure 1.

Metrich is silent regarding the constant current source is controlled as a function of a differential signal of a comparator resulting from the difference between the measuring voltage and a setpoint voltage, a plurality of pump cells is provided and the outer electrode of each pump cell receives the pump current, air is present in the reference-gas space and the set point voltage is set to a value between 300 mV to 700 mV.

Miyata discloses an air-fuel ratio sensor; wherein, the pump current is controlled as a function of a differential signal of a comparator resulting from the difference between the measuring voltage and a setpoint voltage (8:41-52, the pump current is controlled as a function of the difference between the measured voltage and a reference voltage or setpoint voltage determined by a differential amplifier or comparator). The reference voltage is 450 mV (8:53-67).

At the time of the invention, one with ordinary skill in the art would have found it obvious to modify the device of Metrich with the comparator for controlling the

pump current in the manner recited by Miyata because doing so would allow one to detect the oxygen concentration quickly after the heater is energized (Miyata, 3:30-32). Furthermore, the comparator and the manner of controlling the pump current as disclosed by Miyata would still allow one to control the pump current of Metrich as well as allowing said current to be controlled without being affected by the internal resistance of the measuring cell (Miyata, 5:14-30).

Kato discloses a gas sensor; wherein, atmospheric air is introduced into the reference-chamber as the reference gas (7:66-8:6).

At the time of the invention, one with ordinary skill in the art would have found it obvious to modify the device of Metrich with using atmospheric air as reference gas because all the elements are known in the art and the difference is the combination of known elements into a single device by using the atmospheric air as reference gas. Furthermore, the atmospheric air, separate or in combination, would not have performed a materially different function for one would still obtain the predictable result of sensing the concentration of oxygen with the atmospheric air as reference as in the manner disclosed by Kato (Kato, 7:66-8:6).

Hamada discloses an oxygen gas sensor (figure 5); wherein, the sensor comprises a plurality of pump cells having a common outer pump electrode 22. Furthermore, the outer electrode 22 of the plurality of pump cells receive the pump current, which is controlled by the magnitude of the signal generated from the measuring cell (5:46-64).

At the time of the invention, one with ordinary skill in the art would have found it obvious to modify the device of Metrich with the plurality of pump cells with the

outer electrode of each pump cell receiving the pump current in the manner disclosed by Hamada because doing so would allow one to compensate for the sensor output for a chronological change (Hamada, 5:46-64) and improving the sensitivity of the sensor (Hamada, 5:7-11).

11. Claims 40-41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Metrich (US 5,312,538) in view of Mizutani et al. (US 4,927,517).

Addressing claims 40-41, Metrich discloses an analog-to-digital converter CAN in series with the measuring electrode 7 situated in the reference-gas space and receive the measured voltage from the measuring electrode 7 (figure 1). Furthermore, a comparator (the microprocessor) receives a digitized voltage from the analog-to-digital converter (4:1-20).

Metrich is silent regarding a sample-and-hold circuit, which is connected to the measuring electrode situated in the reference-gas space and is in series with the analog-to-digital converter.

Mizutani discloses a gas sensor comprises electrodes 4 and 6; wherein, electrode 4 is exposed to the target gas and the electromotive force between electrodes 4 and 6 is measured (10:35-68; therefore, the electrode 6 is the reference electrode of the gas sensor). Furthermore, figure 3 shows the sample and hold circuit 40 connected to the reference electrode 6 and is in series with the comparator 36 for comparing the measured electromotive force with reference voltages in order to control the pumping current (Mizutani, 10:35-11:2).

At the time of the invention, one with ordinary skill in the art would have found it obvious to modify the device of Metrich with the sample and hold circuit connected to the reference electrode as disclosed by Mizutani and the sample and hold circuit is connected in series to the comparator via series connection to the analog-to-digital converter of Metrich because the sample and hold circuit would store the measured electromotive force in order to control the pumping current supplied to the pump cell (Mizutani, 10:51-11:2).

Response to Arguments

12. Applicant's arguments filed 01/27/2011 have been fully considered but they are not persuasive.

With respect to the Applicant's arguments regarding the 35 USC 102(b) rejections of claims 11-13, 15, 20-23, 25, 29, 35 and 37, the arguments are not persuasive. With regard to the limitation "the device is configured to predefine the number of ON phases and OFF phases", Metrich discloses applying a number of ON phases and OFF phases of the positive constant current until the measured voltage Vs switches over (figures 2A and 2C); likewise, the device of current application applies ON phases and OFF phases of the positive constant current until the measured voltage switches over (figures 3a-3b). It is clear that the device of Metrich is configured to function in the same manner as that of current application and the limitation "is configured to predefine the number of ON phases and OFF phases" is drawn to the intended use of the device. Hence, the device of Metrich is structurally capable of being configured to predefine the

number of ON phases and OFF phases since the device of Metrich is already configured to perform the other functions of the claimed device.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to BACH DINH whose telephone number is (571)270-5118. The examiner can normally be reached on Monday-Friday EST 7:00 A.M-3:30 P.M.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Keith Hendricks can be reached on (571)272-1401. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

BD
09/29/2011

/Keith D. Hendricks/
Supervisory Patent Examiner, Art Unit 1724